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Publication date:
2019

Raman Spectroscopy for Monitoring Aqueous Phase Hydrogen Sulphide Scavenging Reactions with Triazine: A Feasibility Study

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RAMBØLL

Gas Stream Hydrogen Sulphide (H_2S) Scavenging

1

Offshore oil and gas production:

- H_2S is present in production fluids
- In the gas stream H_2S needs to be reduced to below 5 ppm

Why reduce H_2S?

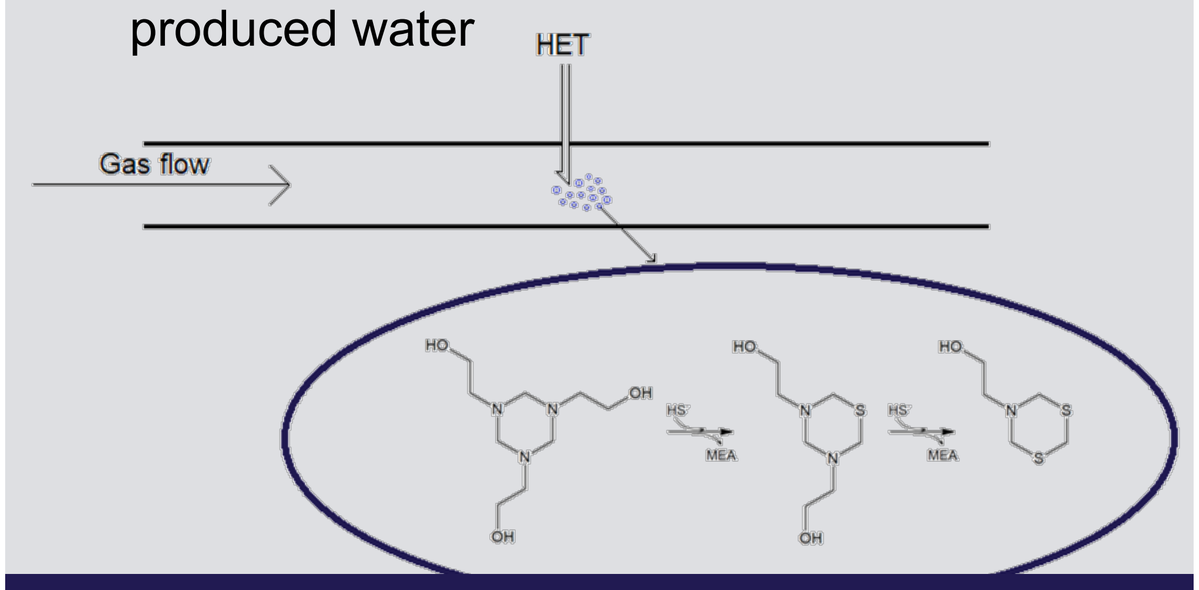
- Toxic and corrosive
- Problematic for structure integrity, safety

How to reduce H_2S offshore?

- Injection of H_2S scavengers transforming H_2S into less harmful substances (spent scavengers)
- The most common scavenger being a derivative of s-triazine (HET)

Offshore H_2S scavenging is problematic because:

- High operating cost for chemical consumption
- Fouling caused by spent scavengers
- Discharge of spent/unspent scavengers into produced water



Objective

2

Open problem:

- Quantitative data for chemical engineering design is lacking
- The reaction is difficult to monitor

Prove that Raman Spectroscopy can monitor the scavenging reactions online

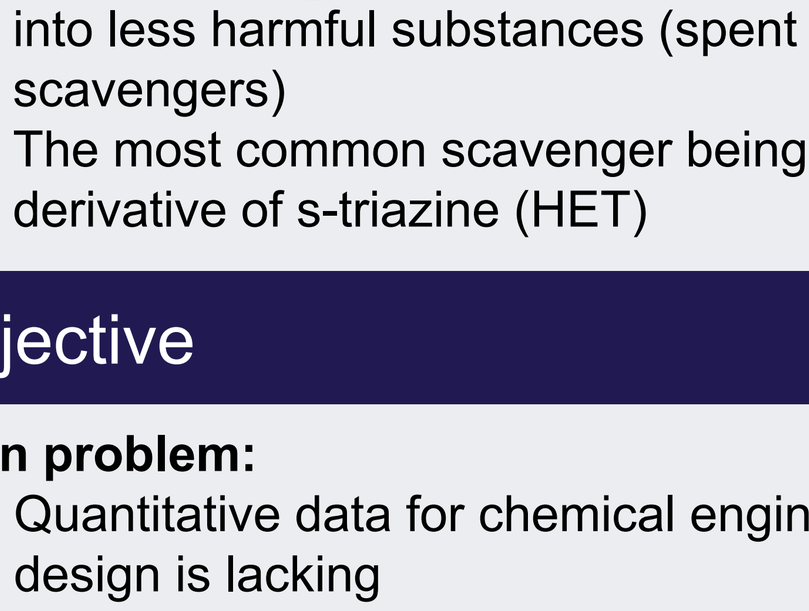
Method

3

- Mix aqueous solutions of HET and HS^-
- Initiate reaction by setting pH
- Aquire spectrum every 1 minute
- Analyse data with chemometrics

Set up

4



Acquired Spectral Data

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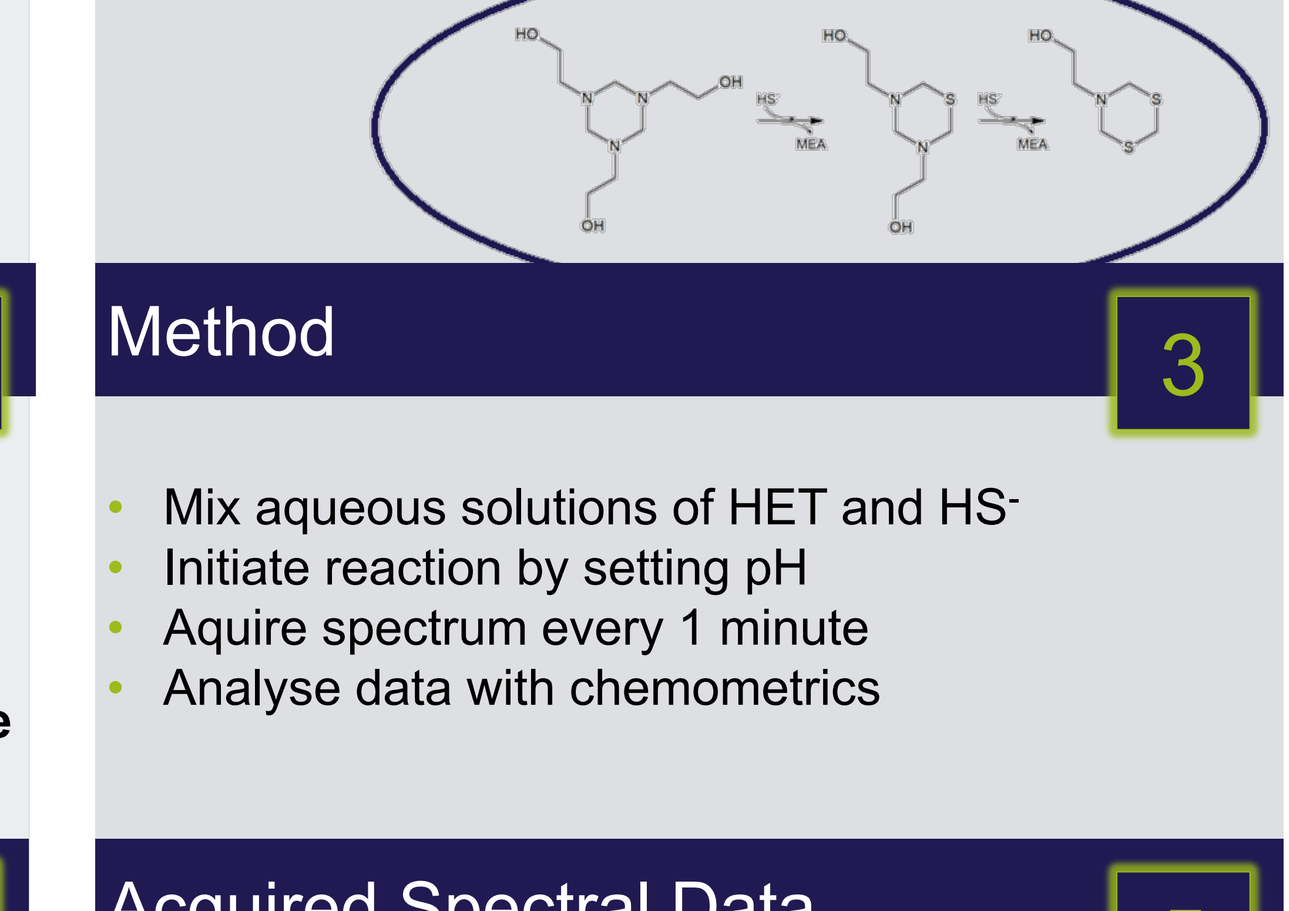
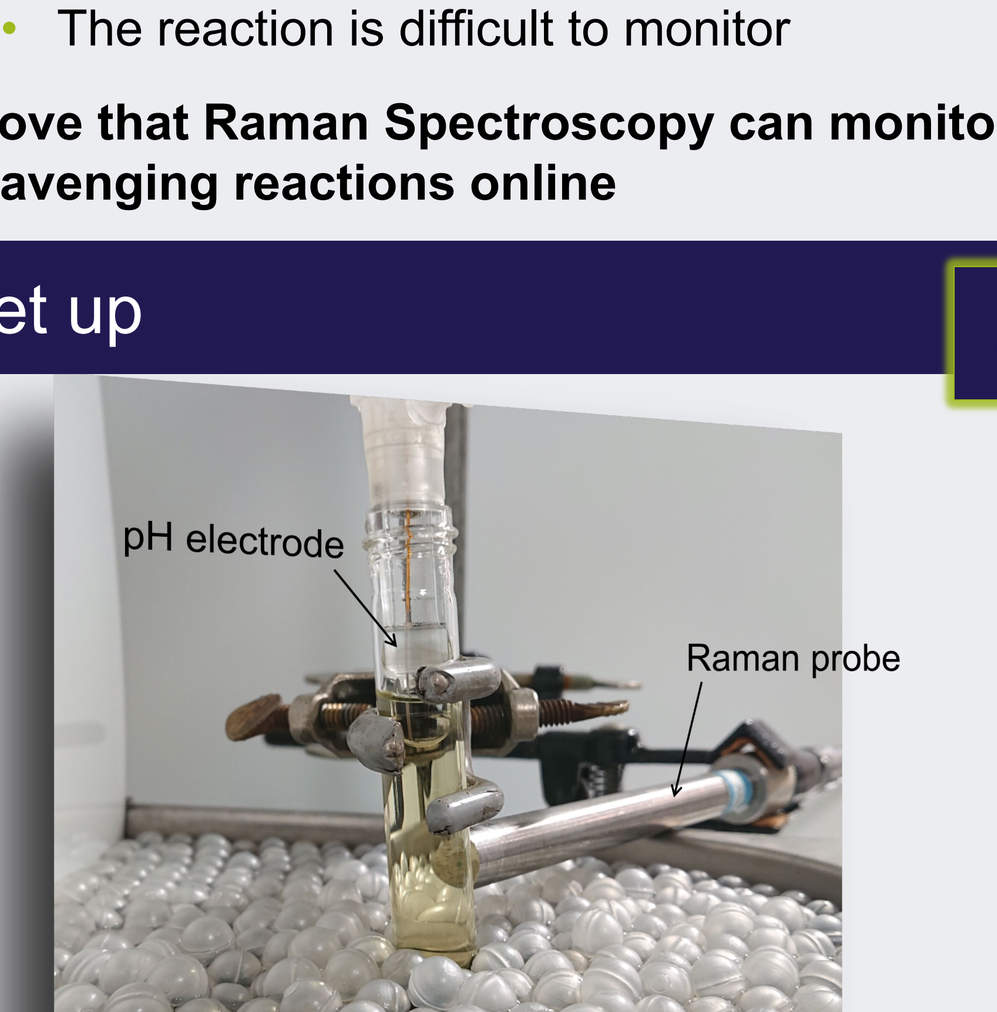


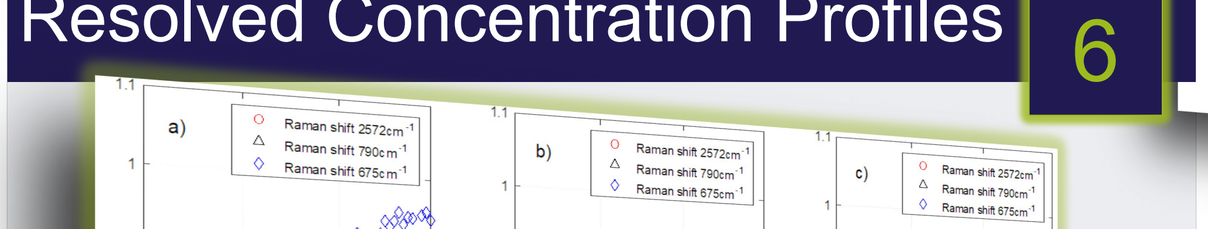
a) Full spectrum
b) Indicator peaks for HET and scavenging products
c) HS^- peak

Resolved Concentration Profiles

6



a) HET load 3.48 mmol; pH (t = 0) = 8.6; b) HET load 3.49 mmol; pH (t = 0) = 9.3;
c) HET load *1.71 mmol; pH (t = 0) = 9.2*



Conclusion

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Raman shows promising results for quantitative analysis of the scavenging reaction

- Faster reaction rate at higher HET concentrations
- Faster reaction at pH 8.5 compared to 10.3
- Reaction not observed at 40°C or below within 30 min

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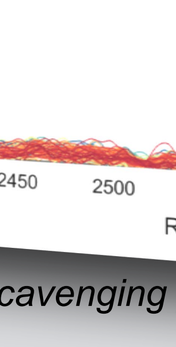

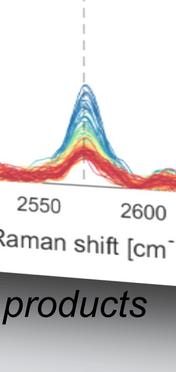

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